Plug-in connector comprising a secondary locking mechanism impinged by a spring force

The present invention concerns a plug-in connector, in particular for airbag retaining systems according to the preamble of patent claim 1. Such a plug-in connector is known from DE 100 35,726 A1.

In several respects, stringent requirements are placed on such plug-in connectors relative to the reliability of the connection that is produced and of the plugging-in process of a plug-in connector into its mating connector. In addition, the plug-in connection must be designed for a very long service life, during which fatigue phenomena of the seating of the plug must not occur.

A plug-in connector with a secondary locking mechanism is known from EP-1,207,591 A2, in which, during the plugging-in process of the connector into a corresponding mating connector and after the engaging of a primary locking mechanism, a secondary locking mechanism is moved into a slot between a tongue of the primary locking mechanism and the connector housing, in order to fill this slot and to prevent the primary locking mechanism from popping out of its locked position. In this case, the tongue of the secondary locking mechanism is continually under elastic strain in the final state, so that it may become subject to material fatigue, and, as the case may be, to material fracture over the long term. If pieces of the tongue of the secondary locking mechanism fall out of the slot, the secondary locking would therefore no longer be secure. At the very least, the correct seating of the plug-in connector in its mating connector would no longer be secure.

An electrical connector is known from DE 196 20,177 A1, in which an electrical contact between complementary connectors is first made toward the end of the plugging-in process in such a way that, during the plugging-in process, a spring is tensed, which moves the connectors into one another when a predetermined spring force has been exceeded and after release of its spring excursion.

DE 198 47,872 A1 describes an ignition bus housing with a secondary locking mechanism, which is pre-tensed by a spring during the plugging-in process and after engaging of the connector locking mechanism, moves by spring force over the connector lock and blocks it in its locking position.

In DE 100 05,858 A1, a spring clip acting as a safety device provides for the circumstance that the secondary locking can only take place when the connection of the connector has been concluded.

DE 100 35,726 A1 shows a contact support, in which a secondary locking mechanism is held back during the plugging-in process until the locking mechanism has been engaged. A spring tension is built up during the plugging-in process, and when this is released it moves the secondary locking mechanism into its final position. This release takes place after the spring tension has become large enough, due to the compression of the spring, in order to overcome an elastic resistance, which is formed by an elastic compressible clamp. The behavior of the latter

determines the time point for triggering and this time can thus be determined only imprecisely and is hardly reproducible.

A plug-in connector with a secondary locking mechanism is known from EP 1,006,621 A1, wherein the secondary locking mechanism rests on one edge of the mating connector, until it is released by shifting laterally at a specific stage of the connecting process.

The object of the present invention is to further develop a plug-in connector of the type named initially in such a way that the secondary locking mechanism is supported by spring force at a pre-specified moment during the plugging-in process and is brought into its final position, but essentially rests free of mechanical strain in the final state.

This object is solved according to the claims.

The present invention is based on the concept of building up a spring force during the connecting process, by means of which the secondary locking mechanism is "catapulted" into its final position after the primary locking mechanism is engaged, and it then rests with essentially relaxed spring elements.

The spring elements can stand under slight mechanical strain in the final state, in order to prevent a chattering in the case of vibrations. The invention will be explained in more detail in the following, based on the description of an example of embodiment, which is not to be understood as limiting, with reference to the drawing.

The following are shown therein:

Fig 1 an exploded view of the plug-in connector according to the invention,

Figs. 2 to 6 the individual steps of the plugging-in process, and

Fig. 7 the unlocking of the plug-in connector from its mating connector.

Fig.1 shows an exploded view in perspective of the plug-in connector 1 according to the invention. The housing is designed of two parts and is comprised of a housing part 3 on the connector side and a housing part 2 on the side turned away from the connector, and these parts are locked with each other. The housing part 3 on the connector side has locking arms 4a, 4b, with which the plug-in connector 1 is locked in a mating connector 7 (Fig. 3). Within housing 2, 3, a secondary locking mechanism 5 is found, which has tongues 6a, 6b, which, after locking of the locking arms 4a, 4b in the mating connector 7, fill a gap between the body of the plug-in connector and the locking arms 4a, 4b and thus prevent a swinging back of the locking arms 4a, 4b out of their locking position.

Further, the secondary locking mechanism 5 has detent arms 8a, 8b (Fig. 2), which will be explained in more detail in the following, and are formed like a tuning fork in the example of embodiment which is shown, with beveled free ends, on which are found catch pieces pointing outward. At the beginning of the plugging-in process of the plug-in connector, the secondary locking mechanism is supported by these free ends in its mating connector 7, supported at the edges of a slot in the mating connector. The secondary locking mechanism 5 is attached by

means of four spiral-shaped pressure springs at the back housing part 2 seen in the direction of plugging in, in the example of embodiment shown. The pressure springs are aligned coaxially to the direction of plugging in. In the state as supplied, i.e., the two housing parts 2, 3 are locked with one another, the pressure springs 10a to 10d are either almost not compressed at all or are only very slightly compressed. A slight compression serves to protect the connector from chattering.

The back housing part 2 has longitudinal slots on opposite-lying sides in the direction of plugging in, from which project pieces 13a, 13b, which are formed on the secondary locking mechanism 5. A detaching aid 12 is plugged onto these pieces 13a, 13b by means of slot 14 in its side walls, and this aid surrounds the housing 2, 3 at least partially. This detaching aid can be moved by an operator in the direction opposite the plugging-in direction against the action of the force of the pressure springs 10a to 10d, whereby the locking tongues 6a, 6b and the detent arms 8a, 8b can be pulled out of the mating connector and the plug connection can be detached.

The individual steps of the plugging-in process will be explained in the following on the basis of Figs. 2 to 6.

Fig. 2 shows the as-supplied state of the plug-in connector, in which, as has already been explained above, the pressure springs 10a to 10d are essentially relieved of strain and the free ends 11a, 11b of the detent arms 8a, 8b are arranged protected in the connector part of housing part 3.

Fig. 3 shows the plug-in connector 1 at the moment in which it is mated with mating connector 7, i.e., it is put directly in contact with the latter. The free ends 11a,11b of the detent arms 8a, 8b in this case lie on the front surface of mating connector 7. In other respects, Fig. 3 does not differ from Fig. 2.

The final position of plug-in connector 1 in mating connector 7 is shown in Fig. 4, i.e., the locking arms 4a, 4b are engaged behind shoulders, which are not shown here, of mating connector 7. The plugging-in process has been produced against the spring force of pressure springs 10a to 10d, which are now all almost completely compressed. In this state, the detent arms 8a, 8b are still continually supported at the edges of the mentioned slots in the mating connector 7. This state changes abruptly, right after the detent arms 4a, 4b are snapped in.

Fig. 5 shows this state, i.e., a slight pressure loading in the plugging-in direction of the plug-in connector 1 leads to the condition that the detent arms 8a, 8b are slipped out, pressed away from the edges of the slots in the mating connector 7, by ramps disposed on housing part 3 and the detent arms 8a, 8b are catapulted into the slot by the force of pressure springs 10a to 10d, so that the secondary locking mechanism 5 snaps into its final position, whereby the tongues 6a, 6b are introduced into the slots behind the detent arms 4a, 4b.

Fig. 6 shows this state once more, wherein, however, the free ends 11a, 11b, which are spread apart from one another, of detent arms 8a, 8b are shown, with which the secondary locking mechanism 5 has been locked in mating connector 7.

Fig. 7 shows the unlocking process, wherein the detaching aid 12 is pulled in the direction opposite the plugging-in direction, against the action of the pressure springs 10a to 10d. In this way, the secondary locking mechanism 5 is detached from mating connector 7, so that the secondary locking of locking arms 4a, 4b is abolished and an additional pull on detaching aid 12 pulls the plug-in connector 1 out of the mating connector 7.

The plug connection produced in this way allows only unequivocal states which are also clearly perceived by the user. The "shooting in" of the secondary locking mechanism is clearly perceptible and ends up in a clearly locked state due to the pressure loading. Therefore, the plug-in connector according to the invention assures an increased security, which is particularly essential for use as an airbag connector.